Revised Statement of Work for the Installation of a Multiple Permeable Reactive Barrier (Multi-Barrier) in Mortandad Canyon

Los Alamos National Laboratory
University of California

April 16, 2001

1.0 INTRODUCTION

This Statement of Work (SOW) describes the installation of a multiple permeable reactive barrier demonstration system (multi-barrier) in Mortandad Canyon for *in-situ* treatment of strontium, plutonium, americium, nitrate, and perchlorate. The University of California (UC) has identified a shallow alluvial groundwater system in Mortandad Canyon that is ideal for this demonstration. The current UC University Technical Representative (UTR) for this project is John P. Kaszuba.

2.0 SITE BACKGROUND

The multi-barrier shall be installed in Mortandad Canyon (Figure 1). This site has physical, hydrological and contaminant characteristics favorable to demonstration of this technology. Depth to bedrock is below 30 ft, the width of the canyon bottom is less than 300 ft, and the subsurface flow is confined primarily to the region just below the channel. Radionuclides, including ^{90}Sr, ^{238,239,240}Pu, and ^{241}Am, have been present in alluvial groundwater within Mortandad Canyon. These radionuclides are stable in the dissolved phase and adsorbed onto colloids consisting of calcium carbonate, silica, ferric hydroxide, and particulate organic carbon. Nitrogen (nitrate and total Kjeldahl nitrogen) also occurs in alluvial groundwater in Mortandad Canyon, and recently perchlorates have become a possible concern. A treatability study was undertaken by UC to obtain performance data for the multi-barrier and is attached.

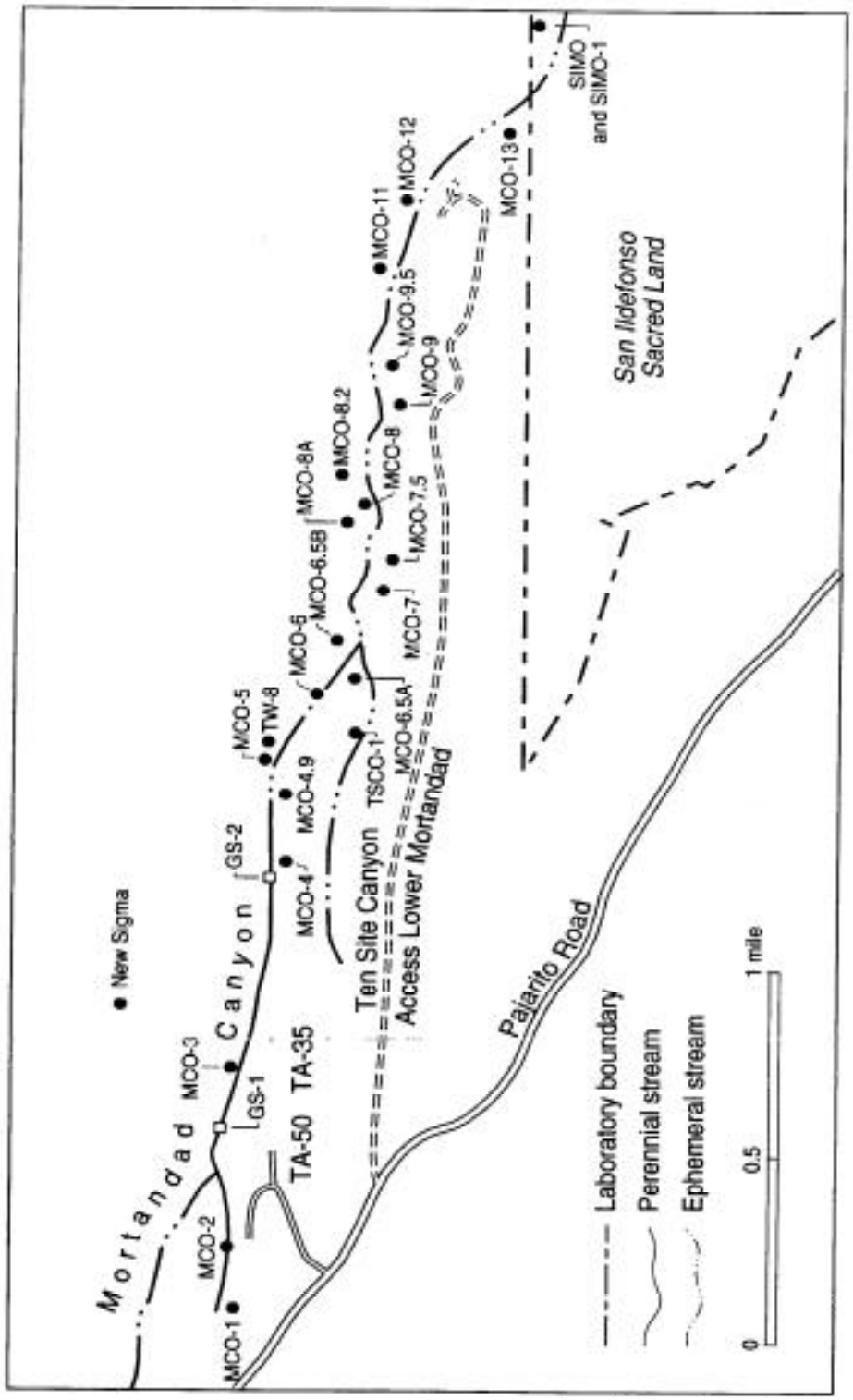
3.0 SCOPE

This SOW describes all of the required activities for the conceptual design, design, and installation of a multi-barrier in Mortandad Canyon to treat groundwater containing strontium, plutonium, americium, nitrate, and perchlorate. However, the project shall be conducted in a phased approach due to limited budgets and the unknown nature of the subsurface in Mortandad Canyon.

The Subcontractor shall provide cost estimates for Title I activities of Site Investigation and Data Review, Permitting and Authorizations, and Conceptual Engineering Design and Cost Estimate for Title II/III. The UTR will only authorize work for the first two of these tasks, Site Investigation and Data Review, and Permitting and Authorizations. The UTR will authorize work to proceed for the third task, Conceptual Engineering Design and Cost Estimate for Title II/III, only if the UTR determines that technical goals can be achieved and cost constraints met for multi-barrier installation. The UTR will make this determination based on the technical information generated in the first two tasks.

The UTR will authorize work to proceed for Title II (Final Engineering Design) and Title III (Field Implementation Plan) only if the UTR determines that technical goals can still be achieved and cost constraints still met for multi-barrier installation. The UTR will make this determination based on the technical information generated in the third Title I task.

The schedule for this project is to award a subcontract by April, 2001 and to complete work as outlined in Table 1 in Section 7.0.



Location of observation wells in Mortandad Canyon.

Figure 1.

This multi-barrier shall be excavated within the alluvium normal to groundwater flow, which is to the east. The barrier shall consist of reactive materials capable of adsorbing americium-241, plutonium isotopes, and strontium-90 and reducing perchlorate to chloride and nitrate to nitrogen gas. These materials shall be arranged into four sequential vertical layers bounded by impermeable vertical walls to prevent flow around the barrier (Figure 2). To avoid ponding and adverse hydrologic impacts of the barrier, the average particle size in the layers shall be gravel-sized, with a saturated hydraulic conductivity about one hundred times greater than the surrounding alluvium and sediments. The multi-barrier shall be equipped with sampling ports to measure hydraulic properties and collect samples for chemical and radiochemical analyses. The multi-barrier shall be installed by September 15, 2001.

The Subcontractor shall provide all labor, materials, equipment, instrumentation, and supervision (except where otherwise specified) necessary to perform the work required by this SOW and the subcontract documents. All work shall be performed under the direction of the UC University Technical Representative (UTR) John P. Kaszuba or his designee and in accordance with this SOW and the SSHASP, Field Implementation Plan, and the following guidance documents identified in Section 4.0.

4.0 APPLICABLE DOCUMENTS

The following document is attached:

Conca, James L., Abdel-Fattah, Amr, Jones, Matthew W., Strietelmeier, Betty A., Ware, Doug, Espinosa, Melissa, Martinez, Bennie A., Garcia, Elmer, Kaszuba, John P., Taylor, Tammy P., and Sauer, Nancy N., 2000, Demonstration of a multiple permeable reactive barrier (multi-barrier) in Mortandad Canyon: Los Alamos National Laboratory Report LA-13780-MS, 46p.

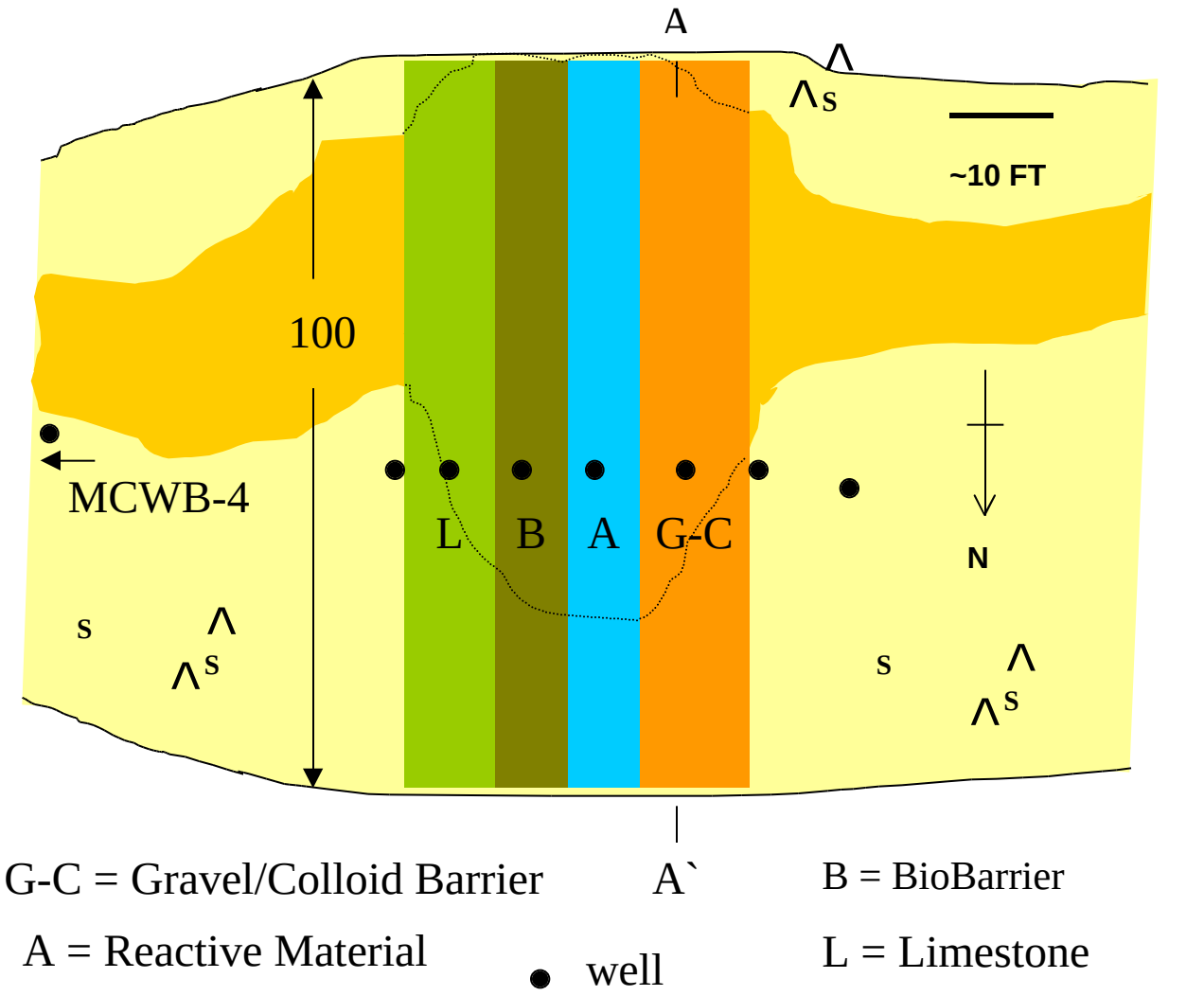
The following documents are available in the open literature:

Conca, James, Lu, Ningping, Strietelmeier, Elizabeth, Ware, S.D., Garcia, Elmer, Jr., Jones, Matt, Espinosa, Mellissa, Martinez, Bennie, Adams, Josh, Sauer, Nancy N., Taylor, Tammy P., Kaszuba, John, Triay, Inés, Longmire, Patrick, Heller, Paula, and Wright, Judith, 2000, Remediation of metal-contaminated groundwater using permeable reactive barriers – Assembling a reactive media toolbox: Proceedings from the 2000 Theis Conference, September 15-18, Jackson Hole, The National Ground Water Association (NGWA) and The Association of Ground Water Scientists & Engineers (AGWSE), Westerville, OH.

Redox Manipulation for Groundwater Remediation, Technical session T104, Geological Society of America, Abstracts with Programs, v. 32, no. 7, p. A-65-66.

Using Permeable Reactive Barriers to Remediate Ground Water Contaminated by Radionuclides and other Inorganic Contaminants I, Eos, Transactions, v. 80 (46), p. F324-6.

Using Permeable Reactive Barriers to Remediate Ground Water Contaminated by Radionuclides and other Inorganic Contaminants II, Eos, Transactions, v. 80 (46), p. F365-7.



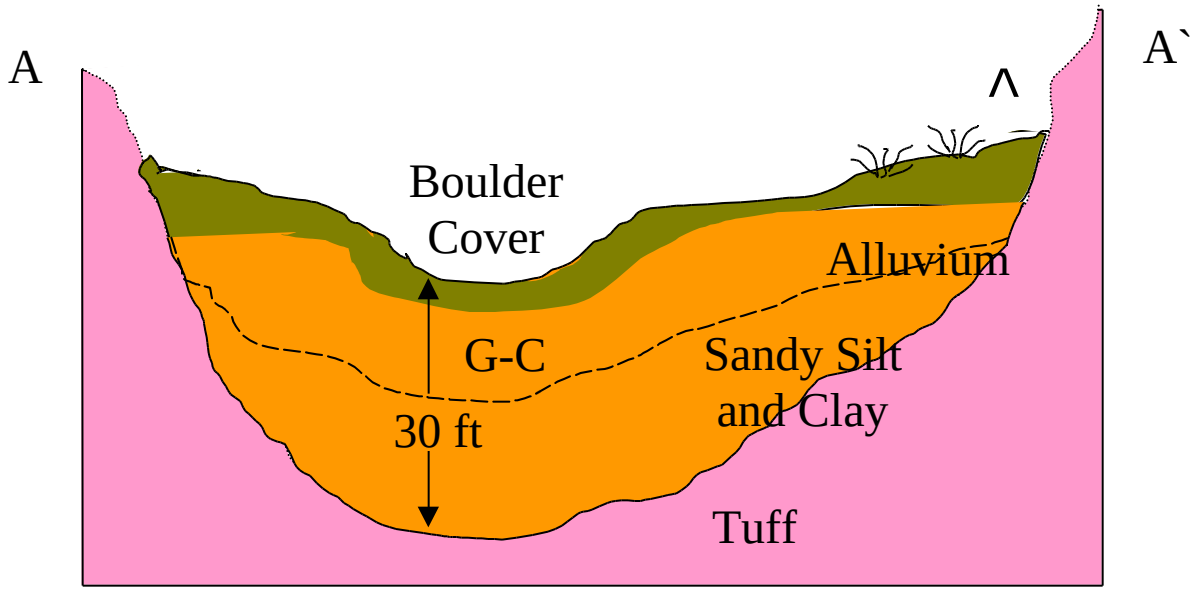


Figure 2. Conceptual design for multi-barrier in Mortandad Canyon to treat Pu, Am, Sr and nitrate in the shallow alluvial groundwater.

The following UC guidance documents are available from the Los Alamos National Laboratory (LANL) web site:

Documenting Personnel Qualifications, QP-2.1, R2, August 1, 2000.

Personnel Orientation and Training, QP-2.2, R1, August 1, 2000.

Reporting and Correcting Nonconformances, QP-3.4, R1, July 1, 1998.

Peer Review Process, QP-3.5, R0, June 9, 1999.

Record Transmittal to the Records Processing Facility, QP-4.4, R1, July 20, 2000.

Document Development and Transmittal Process: Peer Review Required, QP-4.9, R1, June 9, 1999.

Readiness Planning and Reviews, QP-5.3 R1, ER Document Catalog Number ER2000-0168.

Notebook Documentation for Environmental Restoration Technical Activities, QP-5.7 R1, ER Document Catalog Number ER2000-0006, March 27, 2000.

Procurement, QP-7.1 R3, ER Catalog Number ER19990101, September 1, 1999.

Surface Water Site Assessments, ER Project SOP 2.01, September 21, 1999.

Editing and Compositing Guidelines for Preparing ER Project Documents, ER Document Catalog Number ER1999-0173, 3rd edition, March 2000.

Quality Management Plan for the Los Alamos National Laboratory Environmental Restoration Project, ER-QMP, R0, June 10, 1998.

5.0 GENERAL REQUIREMENTS

In completion of all subtasks under this subcontract the Subcontractor shall:

- Strictly adhere to all applicable Environmental Restoration (ER) Project, LANL and DOE ES&H and Quality requirements.
- Perform all work under the Quality Management Plan for the Los Alamos National Laboratory Environmental Restoration Project (QMP) and all implementing procedures, and LANL policies, procedures and requirements (e.g., Laboratory Implementation Requirements, Laboratory Implementation Guidance).
- Incorporate all applicable ER Project quality requirements into all sub-tier subcontracts.
- Obtain prior written approval from the University Technical Representative (UTR) for any deviations from technical or quality requirements.
- Allow access to relevant records and/or personnel by ER Project, UC or DOE personnel in order to verify compliance with provisions of this contract.
- All work shall be performed in accordance with approved UC implementing procedures, or Subcontractor procedures, which have been approved by the UTR prior to the start of any work. A

copy of the Subcontractor's corporate written quality assurance program shall be provided along with the proposal for this Statement of Work.

- Protect DOE, Laboratory and ER Project information and data in accordance with the applicable ER Project implementing procedure to prevent unauthorized use, destruction or loss.
- Ensure Subcontractor personnel meet the minimum personnel qualification requirements, as deemed appropriate or necessary.
- Notify the UTR of any issues that require communications with the Administrative Authority (AA).
- Coordinate all interactions with the AA through the UTR and the Regulatory Compliance Focus Area.
- Obtain field logbooks from the Canyons Focus Area Data Steward and scan all field logbook data for upload into Facility for Information Management, Analysis, and Display (FIMAD);
- Provide Chain-of-Custody and Sample Collection Logs to the CFA Data Steward every two weeks or two weeks after completion of sampling activities. A copy of these documents must also be submitted to the UTR at the time such documents are submitted to the CFA Data Steward.
- Ensure that all Sample Collection Logs from sampling activities are completed and submitted to Central Data Management (CDM) for upload of the field data into FIMAD 30-days after completion of sampling activities. A copy of these documents must also be submitted to the UTR at the time such documents are submitted to the CDM.
- Provide survey coordinate data for all new sample locations within 30 days of the completion of fieldwork to the CFA Data Steward. The Data Steward shall coordinate the file format and upload into FIMAD. A copy of these documents must also be submitted to the UTR at the time such documents are submitted to the CFA Data Steward.
- Any historical or new data that is required from FIMAD to perform this scope of work must be obtained from the CFA Data Steward.
- Submit all archival and historical documents (e.g., records regardless of physical form [see Section 7.0, Deliverables] generated in connection with work performed and according to the provisions of this contract) to the ER Project Records Processing Facility (RPF) in accordance with applicable ER Project procedures. A copy of these documents must also be submitted to the UTR at the time such documents are submitted to the RPF.
- Provide an electronic (disk) version of all-final plans and reports using Microsoft Office software.
- Provide assistance on responses to RSIs and NODs as requested by the UTR.
- The requirements of this SOW are subject to the Price-Anderson Amendments Act (PAAA), and this statement is made to ensure all subcontractors are notified of the EH-Enforcement consequences as addressed in the PAAA "Enforcement of 10 CFR 830 Subpart A, Quality Assurance Requirements" (the PAAA may be found at http://tisnt.eh.doe.gov/enforce/).

<u>All document deliverables shall:</u>

- Adhere to applicable ER Project outlines and/or annotated outlines and be prepared according to the guidance provided in “Editing and Compositing Guidelines for Preparing Environmental Restoration Documents” (current edition).
- Be delivered to the requester in electronic format (if diskettes or other portable media are used, they must be compatible with IBM-PC machines).
- Provide tables and text in Microsoft Word, illustrations in Illustrator (.ai) or (.eps) format unless another format is specifically approved by the requestor, and that the approval must be documented (exceptions to this policy are: line drawings and maps should be submitted as Adobe Illustrator files and photographs as Adobe PhotoShop files).
- Include a complete bibliographic citation (including ER ID numbers) for each included reference.
- Adhere to QP-5.7 for field logbooks.

5.1 Clarification of Quality Assurance Requirements

The Subcontractor shall comply with the following specific requirements prior to the initiation of work, as appropriate.

- *Organization* - The authority and responsibilities of persons or organizations performing work under this statement of work shall be established, documented, and submitted to the UTR within 5 working days of subcontract award. An organization chart identifying specific individuals by name, supported by itemized authorities and responsibilities is a suitable means of documentation.
- *Personnel Qualification* - Personnel performing work shall receive training and indoctrination appropriate to work performed at a UC site. In addition, written personnel qualification requirements shall be established for all positions performing work and provided to the UTR. A list of personnel qualifications shall be submitted to the UTR within 5 working days of subcontract award.
- *Training* - Documented evidence of personnel training and training material content shall be maintained and made available to the UTR. All Subcontractor personnel shall attend additional required job-specific and site-specific training applicable to their job responsibilities (see ER Project training requirements). A matrix of Subcontractor personnel names, titles and required training shall be submitted to UC for approval within 5 working days of award of the subcontract. A completed matrix showing current training for all Subcontractor personnel shall be provided to the UTR and approved by UC before commencement of field activities.
- *Design and Control of Scientific Investigations and Engineered Processes* - All processes shall be performed to UC-approved and controlled procedures or work plans except where excluded in writing by UC. Examples of scientific/engineering processes include calculations; technical design; physical sampling, handling, shipping, and storage; waste management; experiments; tests; chemical, radiological, and biological analyses; environmental remediation and data analysis (e.g., software). All calculations, designs, etc., become the property of UC.
- *Instructions, Procedures, and Drawings* - All work shall be performed to UC-approved and controlled procedures except where excluded in writing by UC. Any procedures prepared shall be done in accordance with guidelines specified by the UTR and submitted in hard copy and electronic media. The Subcontractor's Emplacement and Engineering Design and Field Emplacement Plan shall establish Quality Assurance Addenda which address specific quality controls for work performed by the Subcontractor. Documentation describing the process and products resulting from the process (e.g., data and technical reports) must be adequate for process reproduction (by independent peers). Peer reviews, as evidenced by the reviewer’s authentication, shall be implemented by the Subcontractor on all quality records before submittal to the UTR to ensure adequate quality of the deliverables based on the scope of work.
- *Control of Purchased Items and Services* - Items or services procured under this subcontract shall be performed in accordance with the applicable UC requirements. Only subcontractors with LANL approved QA Programs are allowed procurement and supplier selection authority.
- *Identification and Control of Items* - When applicable, the Subcontractor shall prepare written procedures that ensure that only correct and accepted items are used or installed and that they are traceable through unique identifiers. The procedures shall be submitted to UC for approval.
- *Inspection* – Quality-affecting activities are subject to inspection by UC in accordance with this subcontract.
- *Control of Measuring and Test Equipment* - Activities in which personnel use measuring and test equipment shall be controlled in accordance with the applicable UC procedures. Such devices shall be controlled, calibrated, and adjusted at predetermined levels established by the Subcontractor and approved by UC. Documentation of the Subcontractor's control of measuring and test equipment shall be available to UC for review and verification.
- *Handling, Storage, and Shipping* - Activities requiring personnel to handle, store, package, ship, or receive items, which if damaged, lost, or deteriorated would be detrimental to the work performed by

the Subcontractor, or those activities requiring personnel to handle, store, package, or ship hazardous material shall be controlled by applicable UC procedures.

- *Control of Nonconforming Items* - The Subcontractor shall have a formal program in place to address the control of nonconforming items, and to report these to the UTR. The control of nonconforming items shall apply to all activities that involve the handling of items, including samples, data, raw materials, hardware, and software.
- *Accessibility and Records* - The Subcontractor's work place and working records shall be accessible during normal working hours for verification or audit by UC or their representatives, during the performance of this contract. Each quality record generated shall become the property of UC and shall be turned over to UC within 30 days of completion of the record except where excluded in writing by the UTR.
- *Records Turnover* - All project documents, correspondence, and electronic deliverables that have been executed, completed, approved and which furnish evidence of the quality and completeness of data (including raw data) and of activities affecting quality shall be considered Quality Records and are the property of the US DOE and UC. Quality Records include but are not limited to the following:
- Drawing developed, reviewed and approved, including calculations during Title I, II, and III processes.
- Chain-of-custody forms
- Field and laboratory calibration records
- Field records
- Logbooks
- Survey reports
- Work plans
- Forms completed from Standard Operating Procedures
- Training and qualification records
- Health and Safety Plans
- Permit compliance reports
- Design Field Changes
- Concurrence reports
- Maps
- Photographs
- Electronic Media
- Quality assurance addenda

The above-stated listing (as a minimum) shall be treated as Quality Records and shall be compiled into a records management system that ensures appropriate records are maintained. The system should include provisions for record retention, protection, preservation, change, traceability, accountability, and retrievability. While in storage, records should be protected from damage, loss and deterioration. Within 30 days of project completion, all of the original Quality Records shall be delivered to the UC UTR for authentication.

5.2 Additional Requirements

The Subcontractor shall implement waste minimization practices for all aspects of the scope of work covered by this Statement of Work. The Subcontractor shall provide submittals in accordance with the provisions outlined in the quality assurance requirements. The Subcontractor shall submit the following within 30 days of project completion to the UTR. Additionally, the Subcontractor shall submit any other records requiring submittal to the UTR per this Statement of Work, including:

- Submittals required by Quality Assurance requirements.
- Logbook/Field Notes maintained by designated Health and Safety Representative.
- Copies of all daily pre-work briefing minutes.
- Final copy of OSHA 200 Log
- All health and safety-related documentation including monitoring results and employee notification forms.

6.0 TASK-SPECIFIC REQUIREMENTS

The Subcontractor shall include all labor hours, labor categories, and other direct costs (ODCs) necessary for Tasks 1, 2, and 3 only. The UTR will only authorize work for Tasks 1 and 2. The UTR will authorize Task 3 only if the UTR determines that technical goals can be achieved and cost constraints met for multi-barrier installation. The UTR will make this determination based on the technical information generated in Tasks 1 and 2. The UTR will authorize Tasks 4 and 5 only if the UTR determines that technical goals can still be achieved and cost constraints still met for multi-barrier installation. The UTR will make this determination based on the technical information generated in Task 3. The UTR may alter the scope of Tasks 4 and 5, from what is presented in this document, based on the results of Tasks 1, 2, and 3. No operation and maintenance tasks are included with this project. No closure (decommissioning) plan or re-excavation and disposal of emplaced barrier materials are included with this project.

6.1 Task *1*: Title I Site Investigation and Data Review

6.1.1 Project Plan

The Subcontractor shall:

- Assist UC in updating the Project Plan. The current Project Plan organizes the project, defines roles and responsibilities, and describes in detail how tasks shall be completed. It is arranged according to a Work Breakdown Structure (WBS) and includes a schedule. Other components of the plan include, but are not limited to, a preliminary description of sampling points within and outside of the barrier, an option for disposition of excavated material, design criteria, performance criteria, permitting requirements, a Quality Management Plan, and a Work Plan.
- Advise UC on technical, scheduling, and other aspects of the barrier design and installation.
- Ensure regular contact and clear communication with the UTR during all phases of this project through participation in project meetings and submission of project reports (Section 7.0).

6.1.2 Site Investigations and Data Review

6.1.2.1 Site Data Review

The Subcontractor shall:

- Conduct a review of existing data and reports compiled from investigations and monitoring wells installed within Mortandad Canyon. Data collected from these previous investigations shall be reviewed to determine:
  - Contaminant distribution and movement within the alluvium and groundwater
  - Hydrogeologic profile (e.g., aquifer depth, seasonal fluctuations, groundwater flow velocity and gradient)
  - Stratigraphy and lithology (e.g., depth to bedrock, soil layer configuration)
- Accompany UC personnel to Mortandad Canyon for on-site inspection of 2 candidate locations for geotechnical investigation and site characterization needed for multi-barrier installation.

- Provide assistance to UC personnel to select 2 candidate locations within Mortandad Canyon for geotechnical investigation and site characterization needed for the multi-barrier.
- Provide assistance to UC personnel to establish design parameters.

6.1.2.2 Field Investigations

The Subcontractor shall:

- Conduct a geotechnical investigation to assess the 2 candidate locations of the multi-barrier and determine parameters necessary for the design of the barrier. Parameters determined from the geotechnical investigation may include:
  - Length and depth of the barrier based on aquifer thickness and depth to bedrock
  - Hydraulic conductivity and porosity of soils adjacent to the barrier
  - Grain size distribution of soils adjacent to the barrier
  - Atterberg limits and in-situ moisture content of soils
  - Friction angles and cohesion of soils determined through shear testing to evaluate soil stability during construction.
  - Depth to groundwater.
- Conduct a data review and site characterization, as necessary, to assess the candidate locations of the multi-barrier for the volume and type of contaminated material that shall be removed for installation of the multi-barrier. For this subtask, a small auger rig may be required for penetration and sampling to the anticipated depths of the barrier installation. Determination of the type of contaminated material to be removed shall require laboratory analyses for radioactive, metallic, and organic constituents. If necessary, TCLP (Toxicity Characteristic Leaching Procedure) tests, *etc*., shall be performed to determine the volume of mixed-waste material present at the excavation site. In any case, a characterization of the volume and type of waste material to be excavated, managed, and disposed is required for completion of the Title I phase of this project. The information provided shall be used to project costs related to proper disposal of said wastes. Accurate projections of anticipated waste types and volumes shall be required to proceed to the Title II phase of the project. In addition, water samples will be needed for radiochemical and nitrate characterization.
- Submit a summary of field investigations.

6.1.2.3 Preliminary Emplacement and Safety Analysis

The Subcontractor shall

- Provide safety analysis of the emplacement activities at each scale, especially trenching and removal of alluvium to the surface for the full emplacement.
- Conduct hazard analysis to identify needed equipment.

6.1.3 Progress Reporting

The Subcontractor shall:

- Report on project technical scope, schedule, and cost progress, and other reporting as required to demonstrate the technical progress of the project, as well as reporting progress against budget and schedule baselines. Reporting schedules are listed in Section 7.0.

6.2 Task 2: Title I Permitting and Authorizations

The Subcontractor shall:

- Adhere to the LANL ESH-ID Review Process (http://www.esh.lanl.gov/~esh3/eshid.html). The process has already been initiated by UC.

- Provide input to UC regarding Federal, State and UC permitting requirements and UC environmental and Health and Safety issues, given the Subcontractor's experience in environmental construction projects, particularly construction of reactive barrier systems, and UC procedures.
- Execute all tasks in compliance with all regulatory requirements that are identified ESH-ID Review Process.
- Provide personnel with the required indoctrination and training specific to the work each individual shall be performing at the site, including all UC and OSHA required training.
- Provide personnel whose qualifications comply with UC quality assurance requirements.
- Provide site supervisors and workers that have the minimum training requirements required by UC.
- Prepare a Site-Specific Health and Safety Plan (SSHASP) that addresses worker health and safety during field activities prior to the mobilization of equipment and materials to the site. The SSHASP shall include an Activity Hazard Analysis (AHA) for each activity or task required for installation of the multi-barrier.
- Participate in ER Readiness Review

6.3 Task 3: Title I Conceptual Engineering Design and Cost Estimate for Title II/III

6.3.1 Site Selection

The Subcontractor shall:

- Provide assistance to UC personnel to select the final location for installation of the multi-barrier, based on data gathered from each of the activities described in section 6.1. In providing this assistance, the Subcontractor shall consider:
  - Local site attributes that may impact the design or emplacement of the multi-barrier.
  - Timing of multi-barrier installation.
  - Removal of subsurface materials.
  - Location of existing monitoring wells.
  - Minimizing construction impacts to the canyon (i.e., tree removal, heavy equipment access).

6.3.2 Conceptual Engineering Design

The Subcontractor shall:

- Provide preliminary design for the multi-barrier based on results of the treatability tests supplied by UC and on other information developed by UC and Subcontractor during the execution of this subtask.
- Participate in a conceptual design review meeting with the UTR and the UC personnel selected by the UTR.

6.3.3 Cost Estimate for Title II/III

The Subcontractor shall provide a cost estimate to complete the following:

- Final engineering design of multi-barrier (Title II), to include design review meeting(s) with the UTR and the UC personnel selected by the UTR.
- Emplacement of multi-barrier (Title III), to include
  - Emplacement Plan, including ER Readiness Review, Plan, and SSHASP revisions as needed
  - Materials and Specifications
  - Emplacement, including mobilization and demobilization
- Waste management (waste potentially generated during Title III), including
  - a Waste Management Plan
  - waste management coordinator, as needed

6.4 Task 4: Title II Final Engineering Design

The Subcontractor shall:

- Provide the final design of the multi-barrier, based on data gathered from each of the investigations described in Section 6.1, 6.2, and 6.3. In preparing the final design, the Subcontractor shall:
  - Include input from UC personnel, as delivered in project meetings and other communications.
  - Consider and evaluate all relevant factors such as construction costs, technical feasibility, and installation methods during the design process.
  - Conduct hydrologic calculations to verify that the location and configuration of the multi-barrier is compatible with local hydraulic conditions.
  - Conduct hydrologic calculations to verify that the thickness of the multi-barrier layers provides sufficient residence time to achieve treatment goals.
  - Install sampling ports.
- Prepare engineering controls for managing storm water during construction and following completion of the multi-barrier.
- Consider ancillary factors including revegetation, the potential for fill material above the multi-barrier, and the possibility of a mixed waste excavation.
- Participate in design review meeting with the UTR and the UC personnel selected by the UTR.

6.5 Task 5: Title III Field Implementation Plan (FIP)

6.4.1 Emplacement Plan

The Subcontractor shall:

- Participate in an ER Readiness Review per QP-5.3 (Section 4.0).
- Prepare a comprehensive plan for the emplacement of the multi-barrier. This plan shall address:
  - Site work needed for access
  - Site work needed for erosion control
  - Installation of the multi-barrier
  - Revegetation
  - Fill material above the barrier
  - Other site work that may be needed, based on the Subcontractor's experience in environmental construction projects, particularly construction of reactive barrier systems
- Provide safety analysis for the Emplacement Plan. This analysis shall focus on incremental activities specific to emplacement under the plan. Procedures and equipment shall be modified as needed to mitigate recognized safety concerns.
- Update the SSHASP (Section 6.2) prior to the mobilization of equipment and materials to the site.

6.4.2 Materials

The Subcontractor shall:

- Arrange for the shipment of barrier materials and other materials needed for the field emplacement of the multi-barrier according to the construction schedule. The amount of each of the four necessary materials (crushed limestone rock, pea gravel or lava rock, pecan shells, and a material to be provided or specified at a later date) will be determined during with Task 4 Final Engineering Design (Section 6.4).

6.4.3 Emplacement

The Subcontractor shall:

- Utilize the UC on-site representative as the primary point of contact during this task. The UC on-site representative will be designated by the UTR.

- Perform mobilization activities, including:
  - Transporting all Subcontractor personnel, equipment, and materials to the project site
  - Assembling/setting up equipment at the project site
  - All necessary preparatory work for constructing the multi-barrier
  - Obtaining UC badges for Subcontractor personnel. Subcontractor personnel shall obtain UC badges before they arrive at the site, if they do not already have such badges.
  - Equipment inspection before entering the site. All equipment and materials mobilized to the UC project site shall have been previously decontaminated and shall be free of contamination, dirt, etc. UC reserves the right to prohibit any equipment or materials not meeting this requirement from entering the site. Any expense resulting from such disallowance shall be borne by the Subcontractor. All equipment mobilized to the UC project site shall be in good working order and shall be free of operational defects (e.g., faulty components, leaks, etc.). All lifting gear used onsite shall be stamped certified and documentation of such certification shall be maintained at the project site.
  - Establishing appropriate work control zones per the SSHASP
  - Posting signs for control of the project
  - Installing any required support equipment for sampling
  - Ensuring that suppliers, trade persons, etc. that must visit the site infrequently to support the project shall obtain badges as needed.
  - Ensuring that all Subcontractor personnel requiring site access are U.S. citizens.
- Perform emplacement activities, including:
  - Installing the multi-barrier per Task 4 Final Engineering Design (Section 6.4)
  - Providing all equipment (including all personal protective equipment (PPE) for Subcontractor personnel), labor, and materials needed to install the multi-barrier in accordance with Task 4 Final Engineering Design (Section 6.4).
  - Providing all equipment, labor, materials, and laboratory analysis for conducting the required industrial hygiene monitoring. This may include, but is not limited to, real-time and/or integrated monitoring for dusts, noise, and heat stress.
  - Ensuring that clearing for utilities is performed prior to intrusive activities.
  - Implementing dust control activities for all soil movement and stockpiling activities. The Subcontractor shall provide all equipment and materials necessary to mitigate dust; i.e., tanks, hoses, fine misting spray nozzles, soil binder, etc. Subcontractor shall supply water necessary for dust suppression activities.
  - Employing strict manufacturers and construction quality assurance to ensure that materials used in the multi-barrier and installation methods conform to drawings and specifications.
  - Inspecting and testing materials used within the multi-barrier to ensure that critical material properties meet specifications, (*i.e*., gradation, composition, and permeability, *etc*.) and providing a certificate of conformance for these materials.
  - Maintaining a current OSHA 200 log at the project site.
- Install monitor wells in accordance with Task 4 Final Engineering Design (Section 6.4).
- Perform demobilization activities, including:
  - Decontaminating Subcontractor equipment.
  - Surveying (i.e., radiological) all equipment surfaces as necessary and documenting this equipment for offsite release.
  - Demobilizing Subcontractor equipment and personnel from the site.
  - Removal of all equipment and materials from the site within 3 weeks of completion of emplacement. The Subcontractor-prepared schedule shall indicate the completion date for the demobilization task.

6.4.4 Waste Management

The subcontractor shall:

- Assume all responsibilities related to characterization, on-site management, and final disposition of the different waste types and volumes anticipated through both the site characterization (Section 6.1.2.2) and during actual excavation for the barrier.
- Produce a Waste Management Plan.
- Provide a trained and experienced Waste Management Coordinator (WMC) to institute correct procedures and execute the required documentation for proper characterization, management, and disposal of contaminated materials. Duties shall include the proper on-site management of excavated materials prior to disposition, especially protection of workers, the public, and the environment. With UC personnel, the WMC shall be present during any regulatory audits of waste management practices at the site by LANL, State, or Federal agents who routinely conduct waste-related audits at LANL. The WMC shall coordinate his/her efforts with UC personnel from the ESH-19, the LANL ER Project, and other groups for correct and cost-efficient disposition of wastes at UC-approved waste disposal sites.

7.0 DELIVERABLES AND SCHEDULE

Within five working days of subcontract award, the Subcontractor shall provide a detailed, critical path work schedule which outlines completion dates for significant milestones for Tasks 1, 2, 3 (Sections 6.1, 6.2, and 6.3). The schedule shall be based on the work hours stated in the Subcontractor's accepted proposal. Changes to the approved schedule shall be subject to approval of the UTR. The schedule shall include the times specified in this Statement of Work for UC to review the Subcontractor's submittals. If UC review time is not specified in this Statement of Work for a particular submittal, the schedule shall reflect five working days for UC review and comment. Deficient and/or rejected submittals shall not constitute a justification for an extension of the subcontract performance period. If at any point during this project the Subcontractor feels a due date stipulated in its schedule couldn't be met, the UTR shall be notified immediately. In addition, the Subcontractor shall provide a plan of action describing how such delays shall be prevented in the future and how the project shall be placed back on schedule. The Subcontractor shall provide this plan of action to the UTR within two days of notifying Contractor of the delay.

Major deliverables for the multi-barrier demonstration are listed in Table 1, in chronological order. The start of the field activities are subject to delay due to the presence of Threatened and Endangered Species that may be resident in Mortandad Canyon. LANL ESH surveys are currently being conducted to address this issue.

Table 1: Project Deliverables

Section Number	Subcontractor Deliverable	Date
6.1.3	Daily Field Activity Reports	With weekly progress reports
6.1.3	Progress Reports	Weekly
6.1.3	Project Meetings	Weekly
6.1.3	Schedule/Cost Reporting	Monthly
6.1.3	Accident/Incident Investigation Reports	1 Day after occurrence
6.1.1	Update to Project Plan	2 weeks after NTP

6.2	Submit SSHASP	3 weeks after NTP
6.2	Perform Readiness Review	1 week after SHASP
6.1.2.1 & 6.1.2.2	Submit Summary of Field Investigations	3 weeks after field investigations completed (1 week after analytical data received)
6.3.2	Submit Conceptual Engineering Design, If Authorized by UTR	3 weeks after Summary Report
6.3.3	Submit Cost Estimate, If Authorized by UTR	1 week after acceptance of Conceptual Engineering Design
6.4	Task 4 Deliverables, If Work Authorized by UTR	To Be Determined
6.5	Task 5 Deliverables, If Work Authorized by UTR	To Be Determined

NTP = Notice to Proceed

The Subcontractor shall provide:

- Daily field activity reports that describe field activities, surveys, sampling, filed monitoring results, or other information, as appropriate.
- Weekly Progress Reports that:
  - include details of all significant events that concern subtask activities;
  - identify the work completed during the past week and for the project to date
  - outline progress and potential delays;
  - include a record of *critical* decisions, verbal directions, telephone conversations, or other communications participated in by the Subcontractor and/or his representatives on matters relative to this SOW;
  - indicate the UC services/support needed in the forthcoming week.
- Monthly schedules showing a four-week rolling schedule window.
- Two sets of original 35 mm photographs (Photo Sets) or digital photographs that document all site preparation, site field work (demolition, excavation, sampling, etc.) and site restoration activities along with a descriptive annotation of the subject of each photo (within 30 days of photo development).
- Video documentation of critical site preparation, site field work (demolition, excavation, sampling, etc.) and site restoration activities (within 30 days of completion of emplacement).
- Biweekly invoicing according to WBS

8.0 GOVERNMENT-FURNISHED PROPERTY

UC is not providing any government-furnished property for this project.

9.0 SPECIAL CONSIDERATIONS

None